

KASNEB

CICT PART II SECTION 3

DATABASE SYSTEMS

WEDNESDAY: 24 May 2017.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question.

QUESTION ONE

- (a) Citing relevant examples, explain how each of the following issues could affect a database:
- (i) Non-atomicity of updates. (2 marks)
 - (ii) Single-user access. (2 marks)
- (b) Triggers are important constructs in database programming.
- Required:**
- (i) Highlight two trigger mechanism design requirements. (2 marks)
 - (ii) Triggers are traditionally used for maintaining summary data such as total summary for a department. Explain why this might no longer be important. (2 marks)
- (c) A good database design requires that you find a “good” collection of relation schemas.
- Required:**
State three goals that guide collection of relation schemas. (3 marks)
- (d) It is important to protect data in a database from malicious attempts to steal or modify.
- Required:**
Explain how each of the following levels of security is enforced:
- (i) Database system level. (2 marks)
 - (ii) Network level. (2 marks)
 - (iii) Human level. (2 marks)
- (e) Two-Phase Locking (2PL) protocols do not guarantee freedom from deadlocks in concurrency control. Citing the reason why, explain how this could be addressed. (3 marks)
- (Total: 20 marks)**

QUESTION TWO

- (a) Differentiate between “physical data independence” and “logical data independence” as used in database systems. (2 marks)
- (b) Use the tables schemas below to answer the questions that follow:

LogInDetails

| | |
|----------|----------|
| Username | Password |
|----------|----------|

EmployeeDetails

| | | | |
|----------|-------|----------|------|
| Username | Empid | basicPay | dept |
|----------|-------|----------|------|

- (i) Justify the type of connectivity required between the two entities above. (2 marks)
- (ii) Identify the primary key and the foreign key in the two entities. (2 marks)

- (c) When working with integrated databases you use ADO.NET to provide a disconnected working mode for the database access applications.

Required:

Explain the reason for the use of this mode when inserting data with Visual Basic.net. (2 marks)

- (d) Consider the staff relation shown below:

| Name | Basic_pay (Sh.) |
|--------|-----------------|
| Ken | 45,000 |
| Tom | 89,000 |
| Mokaya | 188,000 |
| Moffat | 250,000 |

Required:

- (i) Write algebraic notation statement to display all the employees whose basic pay is greater than 100,000 shillings. (2 marks)
- (ii) Write algebraic notation statement to display the name for each employee earning basic salary of less than 100,000 shillings. (2 marks)
- (e) ABC Records is a company that assists musicians record and produce music. Each musician that records at ABC Records has a unique identification number, a name, address and a phone number. ABC Records has instruments, each instrument has a unique identification number, a name such as piano or violin and a musical key like C, E- flat and B- flat. Each album recorded on the ABC Records label has a unique identification number, title, copyright date, a format for instance CD or DVD and an album identifier.

Each song recorded at ABC Records has a title and an author. Each musician may play several instruments and a given instrument may be played by several musicians. Each album has a number of songs on it but no song may appear on more than one album. Each song is performed by one or more musicians, and a musician may perform a number of songs. Each album has exactly one musician who acts as its producer. A musician may produce several albums.

Required:

Draw an entity relationship diagram (ERD) for the above scenario. (8 marks)

(Total: 20 marks)

QUESTION THREE

- (a) The table below is extracted from a table named "Students_Records" in a school management database. Study the table and answer the questions that follow:

| Student_ID | F_Name | L_Name | Email | Province | Country | Continent | Institution |
|------------|----------|--------|-----------------|-------------|---------|-----------|-----------------|
| U001 | Mary | John | mary@yahoo.com | Central | China | Asia | ADE Tech. Coll |
| U002 | George | Pierre | p@gmail.com | Republic | France | Europe | ABC Polytechnic |
| U003 | Lawrence | Isaac | law@hotmail.com | Rift Valley | Kenya | Africa | XYZ Polytechnic |

Required:

- (i) Explain why the table "Student_Records" is in 1NF. (2 marks)
- (ii) Describing a proper guideline, convert the table "Student_Records" into a 2NF. (3 marks)
- (iii) Design a 3NF from (a) (ii) above. (3 marks)
- (iv) Change design in (a) (iii) above to 4NF. (3 marks)
- (b) Summarise the challenges of implementing distributed database systems. (5 marks)
- (c) In transaction processing systems, the database management system (DBMS) interleaves the actions of different transactions instead of executing transactions one after another.

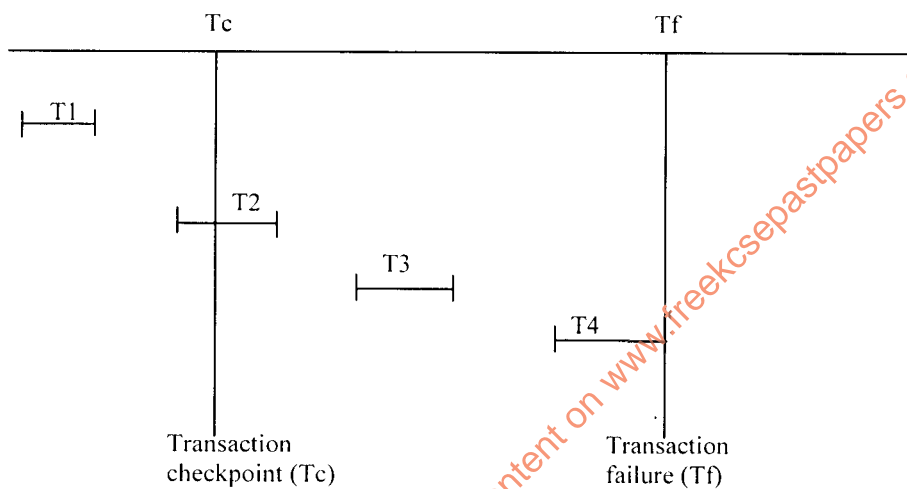
Explain two reasons why this is important.

(4 marks)

(Total: 20 marks)

QUESTION FOUR

- (a) (i) Given the relation,
 Staff(StaffID, FirstName, LastName)
 Write structured query language (SQL) statement to create the relation. (3 marks)
- (ii) Write an SQL statement that will ensure the staffID in (a) (i) above is a primary key and cannot be left empty. (2 marks)
- (iii) Write an SQL statement to create a database where the relation in (a) (i) above is to be stored in a database called "Employees". (1 mark)
- (b) Describe the term "null" as used in database management systems. (2 marks)
- (c) Use a well-labelled diagram to denote the basic architecture in query processing. (6 marks)
- (d) Consider the following case of transaction checkpoint for four transactions:



Required:

Deduce the three likely decisions to be taken after transaction failure (Tf). (6 marks)
(Total: 20 marks)

QUESTION FIVE

- (a) Describe the relationship between "data warehousing" and "data mining". (2 marks)
- (b) Explain two factors that could be used to measure efficiency of a database application system. (4 marks)
- (c) Open Database Connectivity (ODBC) is a standard for an application program to communicate with a database server.

Required:

- (i) State three operations that this standard provides an interface for. (3 marks)
- (ii) Outline three parameters required by the connect () command. (3 marks)
- (d) (i) Describe four possible actions that a DBMS would take in case of integrity violation. (4 marks)
- (ii) Explain two categories that could be violated by insert operation in a database management system. (4 marks)
(Total: 20 marks)
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